tion with high powers, these rodlets are seen to multiply by division into equal, or sometimes slightly unequal, halves. By this method the author hopes also to determine whether the change in shape arises from fusion of two or more individuals or by branching. Their multiplication by division leads to the conclusion that these organisms are members of the Schizomycetes; whether or not they are true Bacteria must, however, still be undecided, until the final stage in their life history has been fully followed.

The X, V, or Y-shaped bacteroid, when once formed appears to be incapable of further growth. These organisms are aërobic in character, their power of fixing atmospheric nitrogen is to be tested in connection with their growth on silicic acid gelatine. Commercial "Nitragin" consists of minute micrococcus-like bodies, all straight and immobile. They multiply rapidly on gelatine media, and in pea extract become converted into "bacteroids" as well as straight rods. Nitragin does consist of the tubercle organism, and as a result of the inoculation of either seeds or soil with it, tubercle formation takes place. Crossing of kinds supplied for different genera and species is quite successful within the tribe Vicieæ. In order to test the possibility and conditions of direct infection of the roots, seedling peas, starting both before and after germination, were grown in sterile tubes, by which means the whole plant was kept under control. This method showed that direct infection of quite young radicles is tolerably certain, also of older roots, provided the conditions under which germination occurred are maintained after infection.

In order to secure infection it is not necessary that the organism should pass through the soil, and the age of the root-hair at the time of infection seems to be without effect upon the result. An accumulation of CO_2 round the roots is not the cause of failure in direct infection.

The addition of nitragin to soils rich in nitrates appears to be inadvisable, but a supply of it to soil poor in nitrates results in an increased yield, though better results are obtained if instead of nitragin, nitrates be added to the soil.

"Preliminary Note on the Spectrum of the Corona." By Sir Norman Lockyer, K.C.B., F.R.S. Received November 11—Read November 24, 1898.

(Plate 4.)

The announcement by Professor Nasini of the possible presence of the characteristic green line of the corona in the spectrum of the gases collected at the solfatara of Pozzuoli,* renders it desirable that I should at once publish some of the results of an investigation relating to the spectrum of the corona with which I have lately been occupied.

* 'Nature,' vol. 58, p. 269, July 21, 1898.

In the course of my early observations of the spectrum of the chromosphere, I discovered on June 6, 1869, a bright line at 1474 on Kirchhoff's scale, which I stated to be coincident with a line of iron.*

During the total eclipse of the sun on August 7, 1869, a green line was recognised by Professor Young as belonging to the spectrum of the corona, and the position of this line was also stated to be 1474K.

Although other determinations of the position of the green line of the corona during eclipses have not all agreed absolutely with Young's observations, the differences have been attributed to errors of observation, so that Young's statement of the coincidence of the coronal and chromospheric lines, and their correspondence with the solar dark line at 1474K has been generally accepted. No special attention appears to have been directed of late years to the measurement of the corona line itself.

This and other coronal radiations were photographed as rings by the use of prismatic cameras in 1893, 1896, and 1898, but a full list of them has only so far been published for the photographs taken by Mr. Fowler during the eclipse of 1893.† Among the brightest of these rings, which is common to all three sets of photographs, is one about wave-length 4231, which probably is identical with the corona line photographed by Schuster in 1886, and stated to have a wave-length of 4232·8 on Ångström's scale (4233·4 Rowland). Schuster stated that this line was "probably the same line as 4233·0 often observed by Young in the chromosphere."‡ The chromospheric line at this wave-length has since been identified as an enhanced line of iron, of which the precise wave-length is 4233·3. Captain Hills photographed this corona line with a slit spectroscope in the last eclipse, and he gives its wave-length as 4233·5,§ which within the limits of error might be considered coincident with the enhanced line of iron.

The later researches on the spectrum of iron have shown that the iron line which I observed in 1869 to be coincident with the bright chromospheric line at 1474K (5316·79 Rowland) is also an enhanced line, agreeing absolutely with Young's latest determination of the wave-length of the 1474 chromospheric line,‖ with which, according to his eclipse observations, the green line of the corona is coincident.

According to these results then, two of the chief lines in the spectrum of the corona would be coincident with enhanced lines of iron. The remaining corona lines, which have so far been measured, are not, however, coincident with enhanced lines. It did not seem

* 'Roy. Soc. Proc.,' vol. 18, p. 76.

† 'Phil. Trans.,' A, vol. 187, p. 593.

‡ 'Phil. Trans.,' A, vol. 180, p. 341.

§ 'Roy. Soc. Proc.,' vol. 64, p. 54.

‖ Scheiner's 'Astronomical Spectroscopy' (Frost's translation), p. 425.

possible, therefore, that two of the enhanced lines of iron should be present without the others, even if it be admitted that the corona may have a temperature high enough to produce any enhanced lines.

It appeared then, either that the coincidences of the chromospheric and coronal lines about 423 and 531 were accidental, or that they were not real coincidences at all. A careful examination of the eclipse photographs of 1896, taken by Mr. Shackleton, and those of 1898, taken by Mr. Fowler, has therefore been undertaken, with special reference to this point.

The wave-length of the coronal ring at 4231, already published in the case of the 1893 photographs, has been confirmed.

The 1896 and 1898 photographs further indicate that the corona line near 4231 is not coincident with the chromospheric line to which reference has been made, and show that while the chromospheric line is coincident with the enhanced line of iron at λ 4233·3, the corona line has a wave-length of 4231·3.

With regard to the ring in the green, the lack of sufficient photographs on isochromatic plates in 1893 does not permit of a final determination of wave-length. Important data, however, were obtained, both in 1896 and 1898. A measurement of the position of the chief ring in the green, as shown in these photographs, comparing the ring with the spectrum of the chromosphere and a solar and iron spectrum taken by the same prisms, shows beyond all question that the wave-length is very different from that generally accepted. The mean result of measurements of different parts of the ring made by Messrs. Fowler and Shackleton and Dr. Lockyer is 5303·7, or about 13 tenth-metres more refrangible than 1474K (5316·79).

Although the new wave-length is not to be regarded as final, for the reason that the conditions under which the photographs were taken necessitate certain small corrections which have not yet been fully worked out, it is not likely that it can be in error by so much as 1 tenth-metre.

The examination of the photographs, which has been undertaken in the first instance by Mr. Fowler, indicates that other important conclusions are to be drawn from the admirable series obtained by him, among them the possible existence of one or more new gases, some of the lines of which, as gathered from the dispersions as yet available, appear also in the spectra of some stars and planetary nebulæ.

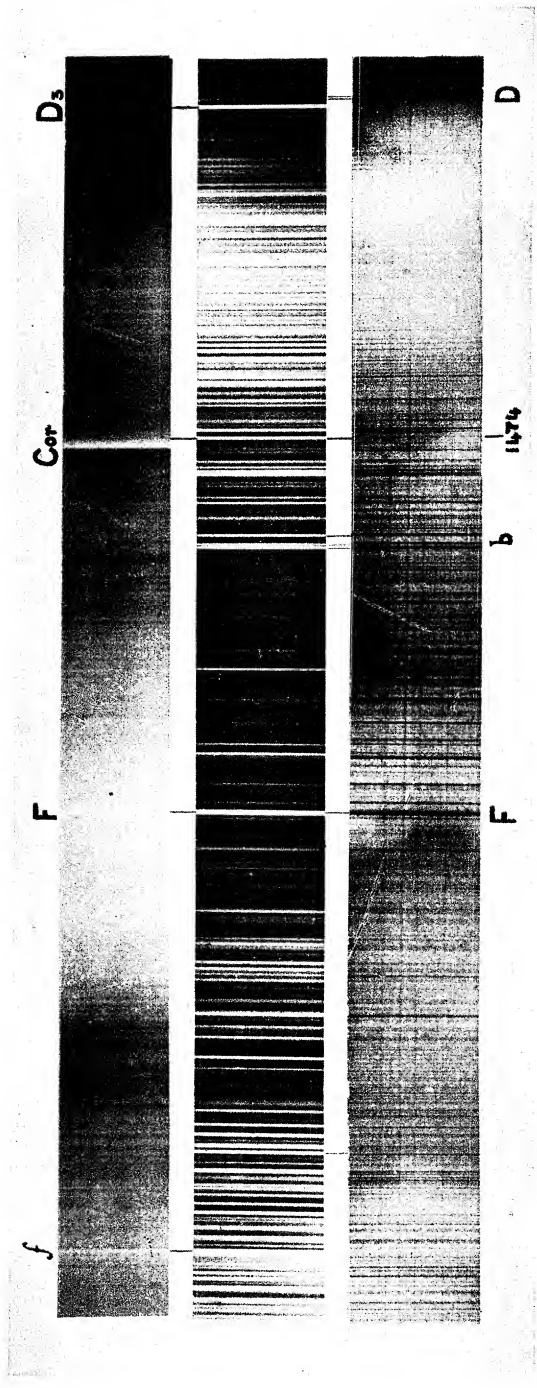
The photograph which accompanies this paper has been prepared by Mr. Fowler.

DESCRIPTION OF PLATE 4.

1. Spectrum of Corona and upper Chromosphere.
2. Spectrum of lower Chromosphere, showing that the chromospheric line at 1474K is not coincident with the corona line.
3. Solar Spectrum.

NOTICE TO BINDERS.

This plate to face page 170 in Royal Society Proceedings, Volume 64 (No. 406).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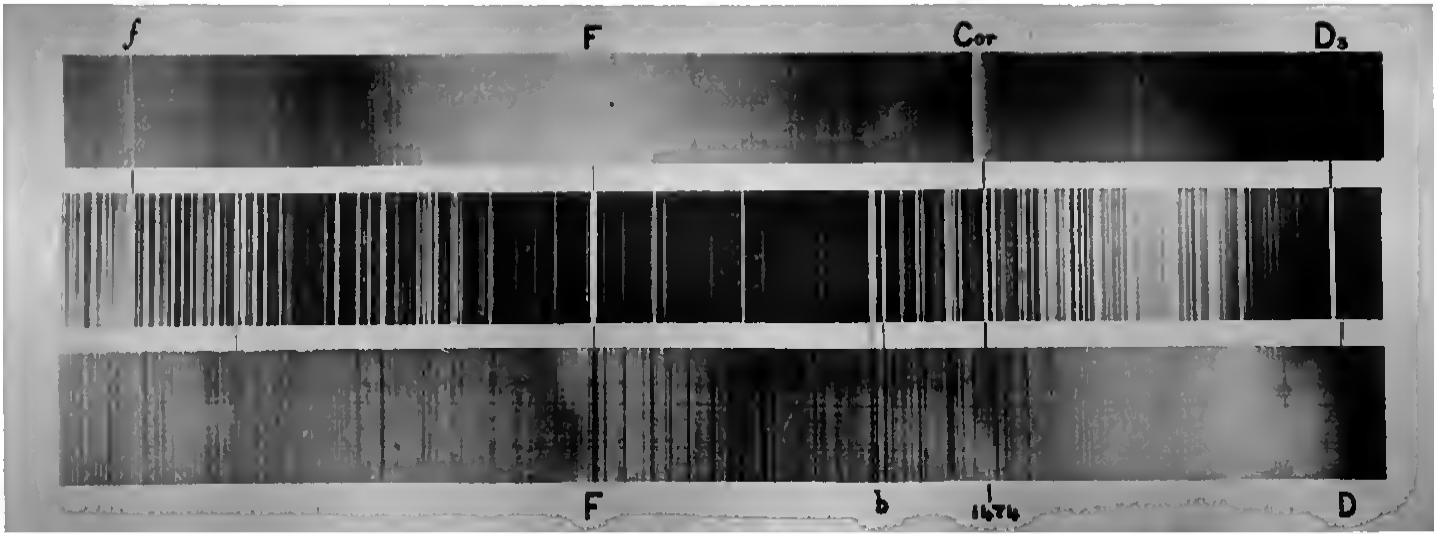

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